REMARKS

This Amendment is responsive to the Final Office Action dated November 1, 2007. Applicant has amended claims 1, 3, 5-8, 10, 17, 19, 25, 29-30, 33-36, and 42. Applicant has also added new claims 43-44. Applicant previously cancelled claim 31. Therefore, claims 1-30 and 32-44 are now pending.

Oath/Declaration

In the Final Office Action, the Examiner stated that the originally filed Oath/Declaration is defective because it does not identify the citizenship of each inventor. Applicant is submitting, along with this Amendment, a newly executed Oath/Declaration that identifies the citizenship of each inventor.

Claim Objections

In the Final Office Action, the Examiner objected to claims 34-39 and 41, because claim 34 was dependent on cancelled claim 31, and because claims 35-39 and 41 were dependent on claim 34. Applicant has amended claim 34 to depend on claim 30, and requests withdrawal of the objections to these claims.

Claim Rejection Under 35 U.S.C. § 112

In the Final Office Action, the Examiner rejected claim 33 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention, because the term "coding signals" in the claim had insufficient antecedent basis. Applicant has amended claim 33 for purposes of clarification. As a result, Applicant respectfully requests withdrawal of the rejection to this claim.

Claim Rejection Under 35 U.S.C. § 103

In the Final Office Action, the Examiner rejected claims 1, 2, 4, 14, 17, 18, 21, 23, 24, 30, 32, 33, 40 and 42 under 35 U.S.C. 103(a) as being unpatentable over Ling et al. (US 2002/0191703, hereinafter "Ling") in view of Onggosanusi et al. (US 2002/0114269, hereinafter "Onggosanusi"). The Examiner rejected claim 3 under 35 U.S.C. 103(a) as being unpatentable

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over Ling in view of Onggosanusi. The Examiner rejected claims 5-8, 10-13, 16, 25-27, 29, 34-36, 38, 39 and 41 under 35 U.S.C. 103(a) as being unpatentable over Ling in view of Onggosanusi as applied to claim 1 above, and further in view of Dabak et al. (US 6,594,473, hereinafter "Dabak"). The Examiner rejected claims 9 and 37 under 35 U.S.C. 103(a) as being unpatentable over Ling in view of Onggosanusi and Dabak as applied to claims 8 and 35 above, and further in view of Sampath (US 2003/0043929, hereinafter "Sampath"). The Examiner rejected claims 15 and 28 under 35 U.S.C. 103(a) as being unpatentable over Ling in view of Onggosanusi as applied to claims 1 and 17 above, and further in view of Hockley, Jr. et al. (US 2004/0008138, hereinafter "Hockley"). The Examiner rejected claims 19 and 20 under 35 U.S.C. 103(a) as being unpatentable over Ling in view of Onggosanusi as applied to claim 17 above, and further in view of Heo et al. (US 2003/0103481, hereinafter "Heo"). The Examiner rejected claim 22 under 35 U.S.C. 103(a) as being unpatentable over Ling in view of Onggosanusi as applied to claim 21 above, and further in view of Hughes-Hartogs (US 4,731,816, hereinafter "Hughes-Hartogs").

Applicant respectfully traverses these rejections to the extent they may be considered applicable to the claims as amended. The applied references fail to disclose or suggest the inventions defined by Applicant's claims, and provide no teaching that would have suggested the desirability of modification to arrive at the claimed inventions.

Independent Claims 1, 17, 30, and 42

The Examiner rejected each of independent claims 1, 17, 30, and 42 over Ling in view of Onggosanusi. Applicant traverses these rejections. However, in order to expedite prosecution of the claims through to allowance, Applicant has amended each of independent claims 1, 17, 30, and 42. As now amended, each of these claims requires a multi-dimensional beamformer that generates a plurality of differently coded data streams from a single stream of symbols and that adjusts a power allocation to each of the differently coded data streams, wherein the multi-dimensional beamformer forms blocks of symbols from the single stream of symbols and then encodes each of the blocks differently to generate the differently coded data streams. Neither Ling nor Onggosanusi, alone or in combination, disclose or suggest at least these claim elements.

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As acknowledged by the Examiner in the Office Action, Ling fails to disclose a beamformer of any kind.[1] Onggosanusi fails to overcome the deficiencies of Ling.

Figures 1 and 2 of Onggosanusi depict a transmitter 10 that includes a channel state processing unit 16 and a single stream transmitter module 18 coupled to the channel state processing unit 16. The channel state processing unit 16 includes sub-channel selection circuitry 24 containing a frequency index selector 28 and beamformer weight determiner 30. The frequency index selector 28 and beamformer weight determiner 30 pass a frequency index and beamformer weights to the single stream transmitter module 18 to select sub-channels for transmitting data.[2]

The single stream transmitter module 18 receives a single coded stream of data via a single input and outputs a single modulated signal stream. This single modulated signal stream is coupled to each of the transmit antennas 14 after being weighted by the corresponding weight vectors supplied by beamformer weight determiner 30. The frequency index and beamformer weights correspond to the selected sub-channel within the stream.[3] Figures 1 and 2 clearly show the single coded stream of data 12 applied to the input of single stream transmitter module 18 and signal modulator 38 of single stream transmitter module 18 producing the modulated signal stream. Thus, Onggosanusi merely describes generating one or more beamformer weights that are applied to the same coded signal stream and applying corresponding weighted signal streams to each of the transmit antennas 14.

In contrast, independent claims 1, 17, 30, and 42 each require a multi-dimensional beamformer that generates a plurality of differently coded data streams from a single stream of symbols. In other words, based on a single input stream of symbols, Applicant's claimed multi-dimensional beamformer outputs a plurality of differently coded data streams. The multi-dimensional beamformer of claims 1, 17, 30, and 42 forms blocks of symbols from the single stream of symbols and then encodes each of the blocks differently to generate the differently coded data streams. For this reason, the present application describes an example embodiment in which each beamformer generates two differently coded data streams from a single stream of symbols. That is, each multi-dimensional beamformer in this example embodiment is a "two-

[1] Page 8, second paragraph of the Office Action dated November 1, 2007.
[2] Page 3, FIGS. 1-2 and paragraphs [0042]-[0045] of Onggosanusi.
[3] Id. See paragraph [0044].

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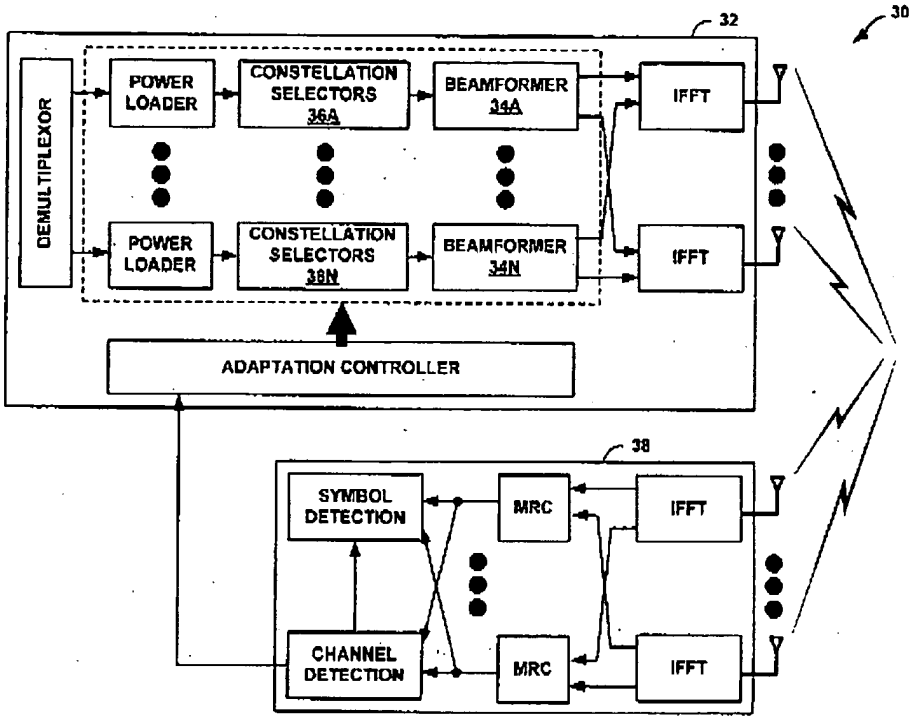
dimensional (2D) beamformer". The two differently coded data streams generated by a given beamformer are then provided to different antennas.

FIG. 12 of the present application illustrates an example embodiment of the claimed invention, and is reproduced below for the Examiner's convenience.



As shown in FIG. 12 and described in paragraphs [0086]-[0131] of the present application, each of multi-dimensional beamformers 34A-N generates a plurality of differently coded data streams from a single stream of symbols. In one non-limiting example, a 2D beamformer may use the Alamouti code to generate two data streams, $\bar{s}_1(n)$ and $\bar{s}_2(n)$, from the original symbol stream, s(n), according to equation (8) of the present application, which is reproduced below for the Examiner's convenience.

$$\begin{bmatrix} \bar{s}_1(2n) & \bar{s}_1(2n+1) \\ \bar{s}_2(2n) & \bar{s}_2(2n+1) \end{bmatrix} = \begin{bmatrix} s(2n) & -s^*(2n+1) \\ s(2n+1) & s^*(2n) \end{bmatrix}.$$

Alamouti's code is used to achieve full rate by transmitting two symbols over two time slots. During the first time slot, a first symbol and a complex conjugate of the second symbol are

transmitted using respective transmit antennas. During the subsequent time slot, the second symbol and the complex conjugate of the first symbol are transmitted using respective transmit antennas. Thus, $\bar{s}_1(n)$ and $\bar{s}_2(n)$ include different data and are characterized as steams of differently coded data.

In contrast to the requirements of Applicant's claims, Onggosanusi describes transmitting the same coded signal over each of a plurality of antennas 14. In Onggosanusi, a single, one-dimensional beamformer applies beamformer weights to the coded signal for the corresponding antennas 14. In contrast to Applicant's claims, each coded signal stream in Onggosanusi includes the **same data** for each time slot.[4] To be clear, the one-dimensional beamformer of Onggosanusi operates on a single stream of symbols to compute weightings. In the case where there are multiple transmitter modules 18, the weights are separately and independently applied to each input data stream to produce a corresponding output signal. Even in this case, the beamformer of Onggosanusi does not produce multiple differently coded data streams from one single input stream of symbols, as required by Applicant's claims. Instead, the Onggosanusi approach would require multiple input symbol streams from multiple single stream transmitter modules 18 in order to produce multiple, differently coded data streams. Indeed, when multiple single stream transmitter modules 18 are used, Onggosanusi states that "[e]ach single stream transmitter module 18 . . . would receive a unique data stream for transmission" (emphasis added).[5] Thus, Onggosanusi fails to disclose or suggest a multi-dimensional beamformer that generates a plurality of differently coded data streams from a single stream of symbols, as required by independent claims 1, 17, 30, and 42, as amended.

In addition, Onggosanusi does not disclose or suggest a multi-dimensional beamformer that also adjusts a power allocation to each of the differently coded data streams, as required by Applicant's claims. In the Office Action, the Examiner referred to the transmit power allocator 26, shown in FIG. 1 of Onggosanusi, with regards to power allocation.[6] Firstly, because Onggosanusi fails to disclose or suggest a multi-dimensional beamformer that generates a plurality of differently coded data streams from a single stream of symbols, Onggosanusi cannot

[4] Page 3, paragraph [0045] of Onggosanusi.
[5] Page 3, paragraph [0044] of Onggosanusi.
[6] See, e.g., page 16, fourth full paragraph of the Office Action dated November 1, 2007.

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possibly disclose or suggest a multi-dimensional beamformer that adjusts a power allocation to each of such differently coded data streams that are generated by the beamformer.

Moreover, the transmit power allocator 26 of Onggosanusi determines a power amplification factor that modulates the signal strength of the stream of data 12 that is processed by the single stream transmitter module 18.[7] In Onggosanusi, transmit power available for transmission is allocated only between selected sub-channels of the stream of data 12 that is processed by single stream transmitter module 18. In contrast, Applicant's claims require that a multi-dimensional beamformer adjusts a power allocation to each of the differently coded data streams generated by the beamformer. Even when multiple single stream transmitter modules 18 are used in Onggosanusi, transmit power allocator 26 would allocate power across selected sub-channels of the multiple unique data streams that are provided as input to the multiple single stream transmitter modules 18. Nowhere does Onggosanusi disclose or suggest any form of power allocation to differently coded data streams that are generated by a multi-dimensional beamformer from a single stream of symbols, as is required by Applicant's amended claims 1, 17, 30, and 42.

For at least the reasons outlined above, Ling and Onggosanusi do not support a prima facie case for obviousness with respect to Applicant's independent claims 1, 17, 30, and 42 under 35 U.S.C. § 103(a). Withdrawal of these rejections is requested.

Dependent Claims 2-16, 18-29, and 32-41

Claims 2-16 depend, either directly or indirectly, on independent claim 1. Claims 18-29 depend, either directly or indirectly, on independent claim 17. Claims 32-41 depend, either directly or indirectly, on independent claim 30. For at least the reasons outlined above regarding amended independent claims 1, 17, 30, and 42, Ling and Onggosanusi fail to disclose or suggest each and every element of dependent claims 2-16, 18-29, and 32-41. The remaining applied references of Dabak, Sampath, Hockley, Heo, and Hughes-Hartogs fail to overcome the deficiencies of Ling and Onggosanusi. Dabak, Sampath, Hockley, Heo, and Hughes-Hartogs also fail to disclose or suggest a multi-dimensional beamformer that generates a plurality of differently coded data streams from a single stream of symbols and that adjusts a power

[7] Page 3, paragraph [0043] of Onggosanusi.

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allocation to each of the differently coded data streams. Therefore, for at least these reasons, Applicant requests withdrawal of the rejections to dependent claims 2-16, 18-29, and 32-41.

In addition, claims 5 and 25, as amended, require that a beamformer comprise a space-time block coder that processes the single stream of symbols from the constellation selector by forming the blocks of symbols from the single stream of symbols and then space-time coding each of the blocks differently to generate the plurality of differently coded data streams as a plurality of space-time block coded data streams. Onggosanusi fails to disclose or suggest these additional elements of claims 5 and 25. As outlined above, Onggosanusi describes transmitting the same coded signal over each of a plurality of antennas 14. Each coded signal stream in Onggosanusi includes the **same data** for each time slot. Onggosanusi does not disclose or suggest a space-time coding of multiple blocks differently in order to generate differently coded data streams based upon a single stream of input symbols, as required by claims 5 and 25. When multiple single stream transmitter modules 18 are used in Onggosanusi, multiple input symbol streams are required in order to produce multiple, differently coded data streams. Thus, Onggosanusi fails to disclose or suggest a beamformer comprise a space-time block coder that processes the single stream of symbols from the constellation selector by forming the blocks of symbols from the single stream of symbols and then space-time coding each of the blocks differently to generate the plurality of differently coded data streams as a plurality of space-time block coded data streams, as required by claims 5 and 25. The remaining applied references fail to overcome the deficiencies of Onggosanusi. For at least these reasons and the reasons outlined above regarding the independent claims, Applicant requests withdrawal of the rejections to these claims.

In addition, Applicant submits that Onggosanusi fails to disclose or suggest the elements recited in claim 3, as amended. This claim requires that the constellation selector select the signal constellation based, at least in part, on channel mean feedback received from a second wireless communication device when producing the single stream of symbols that is then used by the multi-dimensional beamformer to generate the differently coded data streams. Paragraph [0108] of Onggosanusi discloses the use of a feedback channel, wherein the receiver may feed back certain information to the transmitter. However, this form of feedback is not based, at least in part, on channel mean feedback that may be used by a constellation selector when producing a

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single stream of symbols that is then used by a multi-dimensional beamformer to generate differently coded data streams. Ling also fails to disclose this type of feedback. Paragraph [0129] of Ling discloses the use of partial-CSI (channel state information) feedback techniques and full-CSI feedback techniques. However, Ling fails to disclose the use of channel mean feedback that may be used by a constellation selector when producing a single stream of symbols that is then used by a multi-dimensional beamformer to generate differently coded data streams. For at least these reasons and the reasons outlined above regarding the independent claims, Applicant requests withdrawal of the rejections to claims 3 and 32.

Summary

Therefore, for at least these reasons, the applied references fail to establish a prima facie case for non-patentability of Applicant's claims 1-30 and 32-42 under 35 U.S.C. 103(a). Withdrawal of the rejections to these claims is requested.

New Claims

Applicant has added new dependent claims 43-44, which are fully supported by the original disclosure. Claims 43-44 each depend directly on claim 1. For at least the reasons outlined above regarding claim 1, claims 43-44 are patentable over the applied references. In addition, Applicant submits that none of the applied references disclose or suggest a two-dimensional beamformer that produces two different Alamouti coded data streams that are power loaded and transmitted along two orthogonal basis beams, as required by claim 43. Applicant further submits that none of the applied references disclose or suggest a multi-dimensional beamformer that adjusts the power allocation to each of the differently coded data streams based at least in part on channel mean feedback received from a second wireless communication device, as required by claim 44. As a result, Applicant requests consideration and allowance of these new claims.

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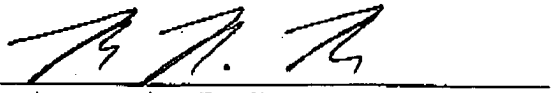
CONCLUSION

All claims in this application are in condition for allowance. Applicant respectfully requests reconsideration and prompt allowance of all pending claims. Please charge any additional fees or credit any overpayment to deposit account number 50-1778. The Examiner is invited to telephone the below-signed attorney to discuss this application.

Date:

January 30, 2008

By:



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